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Durchflussregler

Régulateur de débit

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(MOTOYAMA SEISAKUSHO), 9 July 1993,

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EP 0 754 896 B1

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Description**BACKGROUND OF THE INVENTION**

[0001] The present invention relates to fluid controllers such as valves, mass flow controllers or pressure regulators according to the preamble of claim 1.

[0002] Fluid controllers are already known which comprise a controller main body having laterally open inlet channel and outlet channel, and an operating portion integral with the main body for opening and closing the channel, changing the direction of flow, or regulating the rate of flow or pressure. In fabricating a fluid control apparatus comprising various types of such fluid controllers in combination, the main bodies of the controllers are connected to one another (see JP-A-172265/1993).

[0003] If the operating portion of the conventional fluid controller malfunctions, there arises a need for replacement, whereas with the fluid control apparatus comprising fluid controllers the main bodies of which are connected to one another, the entire apparatus must be disassembled for the removal of one of the controllers. The replacement therefore requires a time-consuming cumbersome procedure, which renders the apparatus inconvenient to maintain.

[0004] A fluid controller of the above mentioned kind is also known from DE -A-2 223 115. The fluid control system known from this document comprises a main body, which is formed with an inlet channel and an outlet channel each having a downwardly open end. The main body is further provided with an operating portion, which is formed integral with the main body. A connector is removably attached to the main body, and the connector is formed with an outlet channel and an inlet channel communicating respectively with the inlet channel and the outlet channel of the controller main body. Two gaskets are provided between the controller main body and the connector.

[0005] If the operating portion of the fluid controller malfunctions, there arises a need for replacement. For this purpose the screws, by which the controller main body is connected to the connector must be removed, so that the two seals provided between the controller main body and the connector may be removed and then newly inserted, before a new controller main body can be attached to the connector. The replacement therefore requires a time-consuming composing procedure, which renders the apparatus inconvenient to maintain.

[0006] US 4,796,896 further discloses a seal arrangement, which comprises a rigid container and two seal bodies formed of an elastomeric material and fixedly attached to the retainer, so that the whole arrangement needs to be replaced, when one of the gaskets malfunctions.

[0007] Accordingly it is an object of the invention, to provide a fluid controller having an operating portion which can be replaced readily if malfunctioning.

[0008] According to the present invention this object

is solved by the features of the characterising portion of claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS

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[0009]

FIG. 1 is a view in vertical section showing a fluid controller embodying the invention;

FIG. 2 is an enlarged view in vertical section of a seal;

FIG. 3 is an enlarged plan view of a retainer and gaskets;

FIG. 4 is an enlarged perspective view of the retainer; and

FIG. 5 is an enlarged perspective view partly broken away and showing the gasket.

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DESCRIPTION OF THE PREFERRED EMBODIMENT

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[0010] An embodiment of the invention will be described below with reference to the drawings. The terms "upward," "downward," "right" and "left" are used in the following description based on the position of the device as shown in FIG. 1.

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[0011] FIG. 1 shows a fluid inlet-side portion of a fluid control apparatus for use in systems for producing semiconductors. A first on-off valve 2 and a second on-off valve 4 are disposed at the left side (downstream side) of an inlet pipe joint member 1.

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[0012] The first on-off valve 2 comprises a valve main body 6 formed with downwardly open inlet channel 42 and outlet channel 43, an operating portion 7 positioned on the valve main body 6 and integral therewith for opening and closing the outlet channel 43, and a connector 11 disposed beneath the valve main body 6. The connector 11 is formed with an inlet channel 41 for causing an inlet channel 40 of the joint member 1 to communicate with the inlet channel 42 of the main body 6 there-through, a leftwardly open outlet channel 44 communicating with the outlet channel 43 of the main body 6, and a branch channel 45 branching from the outlet channel 44 and provided with a pressure sensor mount 3. The valve main body 6 comprises a cylindrical portion 14 and a rectangular flange portion 15 formed at the upper end of the portion 14. The cylindrical portion 14 is fitted in an upward recess 16 formed in the connector 11, and is fastened to the connector 11 with screws 17 extending through the flange portion 15 from above at the respective four corners of the flange portion 15. Accordingly, if the operating portion 7 of the first on-off valve 2 malfunctions, the operating portion 7 is removable from the connector 11 together with the valve main body 6.

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[0013] The second on-off valve 4, which has the same construction as the first on-off valve 2 except that the pressure sensor mount is absent, comprises a valve main body 8 formed with downwardly open inlet channel 47 and outlet channel 48, an operating portion 9 posi-

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tioned on the main body 8 and integral therewith for opening and closing the outlet channel 48, and a connector 12 disposed beneath the main body 8. The connector 12 is formed with an inlet channel 46 for causing the outlet channel 44 of the connector 11 of the first on-off valve 2 to communicate with the inlet channel 47 of the main body 8 of the second on-off valve 4 therethrough, and a leftwardly open outlet channel 49 and communicating with the outlet channel 48 of the main body 8 of the second on-off valve 4. The valve main body 8 comprises a cylindrical portion 18 and a rectangular flange portion 19 formed at the upper end of the portion 18. The cylindrical portion 18 is fitted in an upward recess 20 formed in the connector 12, and is fastened to the connector 12 with screws 21 extending through the flange portion 19 from above. Accordingly, the operating portion 9 of the second on-off valve 4 is removable from the connector 12 along with the valve main body 8 if malfunctioning.

[0014] The connector 11 of the first on-off valve 2 is connected to the connector 12 of the second on-off valve 4 with a screw 22 extending through the connector 11 and driven into the connector 12 from the right side of the connector 11. The screw 22 is removed in disassembling the entire apparatus. A seal 27 is provided between the connector 11 and the connector 12. The seal 27 is used in holding the two channels 44, 46 in communication with each other and can be a known one. The connectors 11, 12, although separate members, can be an integral member. The seal 27 is unnecessary in this case.

[0015] A seal 26 is provided also between the cylindrical portion 14 of valve main body 6 of the first on-off valve 2 and the upward recessed portion 16 of the connector 11. The seal 26 is installed when two channels are caused to communicate with two respective channels, that is, when the inlet channels 42, 41 of the main body 6 and the connector 11 are caused to communicate with each other and when the outlet channels 43, 44 thereof are caused to communicate with each other. The seal 26 is an unknown one.

[0016] With reference to FIG. 2, the seal 26 comprises a first annular gasket 28 provided between an edge portion of the valve main body 6 defining the downwardly open end of the inlet channel 42 thereof and an edge portion of the connector 11 defining the upwardly open end of the inlet channel 41 thereof and opposed to the edge portion, a second annular gasket 29 provided between an edge portion of the valve main body 6 defining the downwardly open end of the outlet channel 43 thereof and an edge portion of the connector 11 defining the upwardly open end of the outlet channel 44 thereof and opposed to the last-mentioned edge portion, a retainer 30 holding the two gaskets 28, 29 and attached to the valve main body 6, and a spring pin 31 for positioning the retainer 30 in place. The opposed edge portions defining the open ends of the inlet channels 41, 42 and outlet channels 43, 44 are smooth-surfaced by spot fac-

ing as indicated at 32 for contact with the gasket 28 or 29 and for positioning the gasket with good stability. The spot facing 32 can be dispensed with by polishing the faces to be brought into contact with the gaskets 28, 29.

[0017] The retainer 30 is in the form of an integral piece prepared from a stainless steel plate. As shown in greater detail in FIGS. 3 and 4, the retainer 30 comprises a ring portion 33, a plurality of body holding lugs 34 extending upward from the ring portion 33 for attaching the retainer 30 to the valve main body 6, and gasket holding claws 35, 36 extending radially inward from the ring portion 33 for holding the gaskets. The body holding lugs 34 are four in number, equidistantly spaced apart and bent slightly inward to hold with their resilience a small-diameter portion 14a formed at the lower end of cylindrical portion 14 of the valve main body 6. There are two kinds of gasket holding claws 35, 36, i.e., four large claws 35 equidistantly spaced apart and extending nearly to the center of the ring portion 33, and four small claws 36 positioned between the large claws 35. The claws are slightly resilient. The second gasket 29 is held by the inner ends of the four large claws 35. The first gasket 28 is held by the opposed side edges of adjacent two large claws 35 and the inner end of the small claw 36 between these large claws 35. According to the present embodiment, the first and second gaskets 28, 29 are provided for the two kinds of channels, respectively, i.e., for the inlet channels 41, 42 and for the outlet channels 43, 44, whereas four gaskets as arranged around the second gasket 29 can be held by the retainer 30, each by the opposed side edges of adjacent two large claws 35 and the inner end of the smaller claw 36 therebetween. Thus, the retainer 30 is usable for pairs of opposed inlet or outlet channels. The gasket holding claws 35 or 36 of the retainer 30 are not limited to four in number; the number of claws may be altered with the number of gaskets 28 or 29 to be held.

[0018] As shown in FIG. 5, an annular groove 37 for fitting the gasket holding claws 35, 36 of the retainer 30 is formed in the outer periphery of each of the first gasket 28 and the second gasket 29, whereby the gaskets 28, 29 are reliably held and accurately positioned by the retainer 30. Accordingly, even if the valve main body 6 is repeatedly installed and removed, the gaskets 28, 29 are unlikely to shift relative to the main body 6 and the connector 11, assuring the opposed portions of the main body 6 and the connector 11 of seal properties.

[0019] Like seal 26 is provided also between the cylindrical portion 18 of valve main body 8 of the second on-off valve 4 and the upward recessed portion 20 of connector 18 of the valve 4.

[0020] Although FIG. 1 shows only the fluid inlet-side portion of the fluid control apparatus, the downstream side of the apparatus can be provided with a suitable arrangement of valves similar to the on-off valves 2, 4 and other fluid controllers such as a mass flow controller for controlling the flow rate of fluid, pressure regulator

for controlling the pressure of fluid and a valve for changing the direction of flow. With each of these fluid controllers, a controller main body is attached to a connector disposed beneath the main body with screws driven in from above, and the adjacent connectors are connected to each other with a screw driven in sideways. If the operating portion of one of these controllers malfunctions, the operating portion can then be removed from the connector along with the controller main body.

Claims

1. A fluid controller comprising a main body (6, 8) formed with an inlet channel (42, 47) and an outlet channel (43, 48) each having a downwardly open end and provided with an operating portion (7, 9) integral with the main body (6, 8), a connector (11, 12) formed with an inlet channel (41, 46) and an outlet channel (44, 49) each having an upwardly open end and communicating respectively with the inlet channel (42, 47) and the outlet channel (43, 48) of the main body (6, 8), the connector (11, 12) being removably attached to the main body (6, 8), and a seal (26) is provided between the main body (6, 8) and the connector (11, 12), wherein the upwardly open inlet channel (41, 46) and outlet channel (44, 49) of the connector (11, 12) are each laterally open at another end thereof and that the seal (26) comprises a first gasket (28) provided between an edge portion of the main body (6, 8) defining the downwardly open end of the inlet channel (42, 47) thereof and an edge portion of the connector (11, 12) defining the upwardly open end of the inlet channel (41, 46) thereof and opposed to the edge portion, a second gasket (29) provided between an edge portion of the main body (6, 8) defining the downwardly open end of the outlet channel (43, 48) thereof and an edge portion of the connector (11, 12) defining the upwardly open end of the outlet channel (44, 49) thereof and opposed to the main body (6, 8) edge portion defining the outlet channel end, characterized in that a retainer (30) is detachably holding the first and second gaskets (28, 29) thereto and attached to one of the main body (6, 8) and the connector (4, 12).
2. The fluid controller as in claim 1, further comprising a spring pin (31) for positioning said retainer (30) in place.
3. The fluid controller as in claim 1 or 2, wherein said retainer (30) includes a ring portion (33).
4. The fluid controller as in claim 3, wherein said retainer (30) includes a plurality of body holding lugs (34) extending upwardly from said ring portion (33) for attaching said retainer (30) to said main body (6,

5. The fluid controller as in claim 4, wherein said plurality of body holding lugs (34) includes four body holding lugs which are equidistantly spaced apart from each other and bent slightly inwardly to hold, by means of resilience, a small diameter portion (149) of a cylindrical portion (14) of said main body (6) at a lower end of said cylindrical portion (14).
6. The fluid controller as in any of claims 3 to 5, wherein said retainer (30) includes a plurality of gasket holding claws (35, 36) which extend radially inwardly from said ring portion (33) for holding said first and second gaskets (28, 29).
7. The fluid controller as in claim 6, wherein said plurality of gasket holding claws (35, 36) include a plurality of large-type gasket holding claws (35) and a plurality of small-type gasket holding claws (36).
8. The fluid controller as in claim 7, wherein said plurality of large-type gasket holding claws (35) include four claws equidistantly spaced apart and extending nearly to a center of said ring portion (33) of said retainer (30).
9. The fluid controller as in claim 8, wherein said plurality of small-type gasket holding claws (36) include four claws equidistantly spaced apart and positioned between said four large-type claws (35).
10. The fluid controller as in any of claims 6 to 9, wherein said plurality of small-type claws (36) and large-type claws (35) are all slightly resilient.
11. The fluid controller as in any of claims 6 to 10, wherein said second gasket (29) is held by inner ends of said four large-type claws (35).
12. The fluid controller as in claim 11, wherein said first gasket (28) is held by opposed side edges of two adjacent large-type claws (35) and an inner end of one small-type claw (36) located between said two adjacent large-type claws (35).
13. The fluid controller as in any of claims 6 to 12, wherein said first gasket (28) and said second gasket (29) each have an annular groove (37) in an outer periphery thereof for fitting said gasket holding claws (35, 36) of said retainer.
14. The fluid controller as in any preceding claim, wherein said retainer (30) is an integral piece made from stainless steel.

Patentansprüche

1. Fluidsteuervorrichtung mit einem Hauptkörper (6, 8), der mit einem Einlaßkanal (42, 47) und einem Auslaßkanal (43, 48) versehen ist, die jeweils ein nach unten offenes Ende aufweisen, und einem Betätigungsreich (7, 9), der einteilig mit dem Hauptkörper (6, 8) ausgebildet ist, einem Verbindungselement (11, 12), das mit einem Einlaßkanal (41, 46) und einem Auslaßkanal (44, 49) ausgebildet ist, die jeweils ein nach oben offenes Ende aufweisen und entsprechend mit dem Einlaßkanal (42, 47) und dem Auslaßkanal (43, 48) des Hauptkörpers (6, 8) verbunden sind, wobei das Verbindungselement (11, 12) entferbar an dem Hauptkörper (6, 8) befestigt ist, und einem Dichtungselement (26), das zwischen dem Hauptkörper (6, 8) und dem Verbindungselement (11, 12) angeordnet ist, wobei der nach oben offene Einlaßkanal (41, 46) und der nach oben offene Auslaßkanal (44, 49) des Verbindungs-elementes (11, 12) jeweils an einem anderen Ende seitlich offen sind und das Dichtungselement (26) eine erste Dichtung (28), die zwischen einem Kantenbereich des Hauptkörpers (6, 8), der sein nach unten offene Ende des Einlaßkanals (42, 47) definiert, und einem Kantenbereich des Verbindungs-elementes (11, 12), der das nach oben offene Ende des Einlaßkanals (41, 46) definiert und gegenüber des Kantenbereiches angeordnet ist, vorgesehen ist, und eine zweite Dichtung (29), die zwischen einem Kantenbereich des Hauptkörpers (6, 8), der das nach unten offene Ende des Auslaßkanals (43, 48) definiert, und einem Kantenbereich des Verbindungs-elementes (11, 12), der das nach oben offene Ende des Auslaßkanals (44, 49) definiert und gegenüber dem Kantenbereich des Hauptkörpers (6, 8), der das Auslaßkanalende definiert, angeordnet ist, aufweist, dadurch gekennzeichnet, daß ein Rückhaltelement (30) lösbar die erste und zweite Dichtung (28, 29) an sich hält und entweder an dem Hauptkörper (6, 8) oder dem Verbindungs-element (4, 12) befestigt ist.
2. Fluidsteuervorrichtung nach Anspruch 1, die ferner einen Federstift (31) zur festen Positionierung des Rückhaltelementes (30) umfaßt.
3. Fluidsteuervorrichtung nach Anspruch 1 oder 2, worin das Rückhaltelement einen Ringbereich (33) umfaßt.
4. Fluidsteuervorrichtung nach Anspruch 3, worin das Rückhaltelement (30) eine Mehrzahl von Körperhalteansätzen (34) umfaßt, die sich von dem Ringbereich (33) aufwärts erstrecken, um das Rückhaltelement (30) an dem Hauptkörper (6, 8) zu befestigen.
5. Fluidsteuervorrichtung nach Anspruch 4, worin die Mehrzahl von Körperhalteansätzen (34) vier Körperhalteansätze umfaßt, die im gleichen Abstand voneinander angeordnet sind und leicht einwärts gebogen sind, um mittels Elastizität einen kleinen Durchmesserbereich (149) eines zylindrischen Bereiches (14) des Hauptkörpers (6) an einem unteren Ende des zylindrischen Bereiches (14) zu halten.
10. Fluidsteuervorrichtung nach einem der Ansprüche 3 bis 5, worin das Rückhaltelement (30) eine Mehrzahl von Dichtungshaltekauen (35, 36) umfaßt, die sich von dem Ringbereich (33) zum Halten der ersten und zweiten Dichtung (28, 29) radial einwärts erstrecken.
15. Fluidsteuervorrichtung nach Anspruch 6, worin die Mehrzahl von Dichtungshaltekauen (35, 36) eine Mehrzahl von großen Dichtungshaltekauen (35) und eine Mehrzahl von kleinen Dichtungshaltekauen (36) umfaßt.
20. Fluidsteuervorrichtung nach Anspruch 7, worin die Mehrzahl von großen Dichtungshaltekauen (35) vier Klauen aufweist, die im gleichen Abstand von einander angeordnet sind und sich fast bis zu einer Mitte des Ringbereiches (33) des Rückhaltelementes (30) erstrecken.
25. Fluidsteuervorrichtung nach Anspruch 8, worin die Mehrzahl von kleinen Dichtungshaltekauen (36) vier Klauen aufweist, die im gleichen Abstand von einander angeordnet und zwischen den vier großen Klauen (35) positioniert sind.
30. Fluidsteuervorrichtung nach einem der Ansprüche 6 bis 9, worin alle kleinen Klauen (36) und großen Klauen (35) geringfügig elastisch sind.
35. Fluidsteuervorrichtung nach einem der Ansprüche 6 bis 10, worin die zweite Dichtung (29) von den inneren Enden der vier großen Klauen (35) gehalten ist.
40. Fluidsteuervorrichtung nach Anspruch 11, worin die erste Dichtung (28) von den gegenüberliegenden Seitenkanten zweier benachbarter großer Klauen (35) und einem inneren Ende einer kleinen Klaue (36), die zwischen den zwei benachbarten großen Klauen (35) angeordnet ist, gehalten ist.
45. Fluidsteuervorrichtung nach Anspruch 12, worin die erste Dichtung (28) von den gegenüberliegenden Seitenkanten zweier benachbarter großer Klauen (35) und einem inneren Ende einer kleinen Klaue (36), die zwischen den zwei benachbarten großen Klauen (35) angeordnet ist, gehalten ist.
50. Fluidsteuervorrichtung nach einer der Ansprüche 6 bis 12, worin die erste Dichtung (28) und die zweite Dichtung (29) jeweils eine ringförmige Nut (37) in ihrem Außenumfang umfassen, um die Dichtungshaltekauen (35, 36) des Rückhaltelementes aufzunehmen.

14. Fluidsteuervorrichtung nach einem der vorhergehenden Ansprüche, worin es sich bei dem Rückhaltelement (30) um ein einteiliges Bauteil aus rostfreiem Stahl handelt.

Revendications

1. Régulateur de débit comprenant un corps principal (6, 8) formé avec un canal d'admission (42, 47) et un canal de sortie (43, 48) chacun ayant une extrémité ouverte vers le bas et muni d'une partie fonctionnelle (7, 9) intégralement avec le corps principal (6, 8), un connecteur (11, 12) formé avec un canal d'admission (41, 46) et un canal de sortie (44, 49) chacun ayant une extrémité ouverte vers le haut et communiquant respectivement avec le canal d'admission (42, 47) et le canal de sortie (43, 48) du corps principal (6, 8), le connecteur (11, 12) étant fixé de manière amovible au corps principal (6, 8) et un joint (26) est prévu entre le corps principal (6, 8) et le connecteur (11, 12), dans lequel l'ouverture vers le haut du canal d'admission (41, 46) et du canal sortie (44, 49) du connecteur (11, 12) sont chacune ouverte latéralement à une autre extrémité de celle-ci et que joint (26) comprenant une première garniture (28) prévue entre une partie du bord du corps principal (6, 8) définissant l'extrémité ouverte vers le bas du canal d'admission (42, 47) de celui-ci et une partie de bord du connecteur (11, 12) définissant l'extrémité ouverte vers le haut du canal d'admission (41, 46) de celui-ci et opposé à la partie de bord, une deuxième garniture (29) placée entre une partie de bord du corps principal (6, 8) définissant l'extrémité ouverte vers le bas du canal de sortie (43, 48) de celui-ci et une partie de bord du connecteur (11, 12) définissant l'extrémité ouverte vers le haut du canal de sortie (44, 49) de celui-ci et opposé au corps principal (6, 8) la partie de bord définissant l'extrémité de sortie du canal, caractérisée en ce qu'un moyen de retenue (30) y maintient de manière séparable la première et la deuxième garnitures (28, 29) et fixé à l'un des corps principaux (6, 8) et au connecteur (4, 12).
2. Régulateur de débit selon la revendication 1, comprenant en outre une goupille ressort (31) pour positionner en place ledit moyen de retenue (30).
3. Régulateur de débit selon la revendication 1 ou 2, dans lequel ledit moyen de retenue (30) comprend une partie circulaire (33).
4. Régulateur de débit selon la revendication 3, dans lequel ledit moyen de retenue (30) comprend une pluralité de butées de maintien du corps (34) s'étendant vers le haut depuis ladite partie circulaire (33) pour la fixation dudit moyen de retenue (30) audit

corps principal (6, 8).

5. Régulateur de débit selon la revendication 4, dans lequel la pluralité de butées de maintien du corps (34) comprend quatre butées de maintien du corps qui est séparément espacé de manière équidistante et plié légèrement vers l'intérieur pour maintenir, au moyen de l'élasticité, une petite partie du diamètre (149) d'une partie cylindrique (14) dudit corps principal (6) à une extrémité inférieure de ladite partie cylindrique (14).
6. Régulateur de débit selon l'une quelconque des revendications 3 à 5, dans lequel le moyen de retenue (30) comprend une pluralité de pattes de fixation de la garniture (35, 36) qui s'étend radicalement vers l'intérieur depuis ladite partie circulaire (33) pour le maintien de lesdites première et deuxième garnitures (28, 29).
7. Régulateur de débit selon la revendication 6, dans lequel la pluralité de pattes de fixation de la garniture (35, 36) comprend une pluralité de pattes de fixation de la garniture de type important (35) et une pluralité de pattes de fixation de la garniture de type (36).
8. Régulateur de débit selon la revendication 7, dans lequel la pluralité de pattes de fixation de la garniture de type important (35) comprend quatre pattes séparément espacées de manière équidistante et s'étendant presque à proximité d'un centre de ladite partie circulaire (33) dudit moyen de retenue (30).
9. Régulateur de débit selon la revendication 8, dans lequel ladite pluralité de pattes de fixation de la garniture de type réduit (36) comprend quatre pattes séparément espacées de manière équidistante et placées entre lesdites quatre pattes de type important (35).
10. Régulateur de débit selon l'une quelconque des revendications 6 à 9, dans laquelle ladite pluralité de pattes de type réduit (36) et les pattes de type important (36) sont toutes légèrement élastiques.
11. Régulateur de débit selon l'une quelconque des revendications 6 à 10, dans lequel ladite deuxième garniture (29) est maintenue aux extrémités intérieures desdites quatre pattes de type important (35).
12. Régulateur de débit selon la revendication 11, dans lequel ladite première garniture (28) est maintenue par les bords de côté opposés de deux pattes adjacentes de type important (35) et une extrémité intérieure d'une patte de type réduit (36) placée entre lesdits deux pattes adjacentes de type important

(35).

13. Régulateur de débit selon l'une quelconque des revendications 6 à 12, dans lequel chacune de ladite première garniture (28) et ladite deuxième garniture (29) a une rainure annulaire (37) dans sa périphérie extérieure pour l'adaptation de maintien de ladite garniture des pattes (35, 36) dudit moyen de retenue.

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14. Régulateur de débit selon l'une quelconque des revendications précédante, dans lequel ledit moyen de retenue (30) est un morceau intégral réalisé en acier inoxydable.

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FIG.1

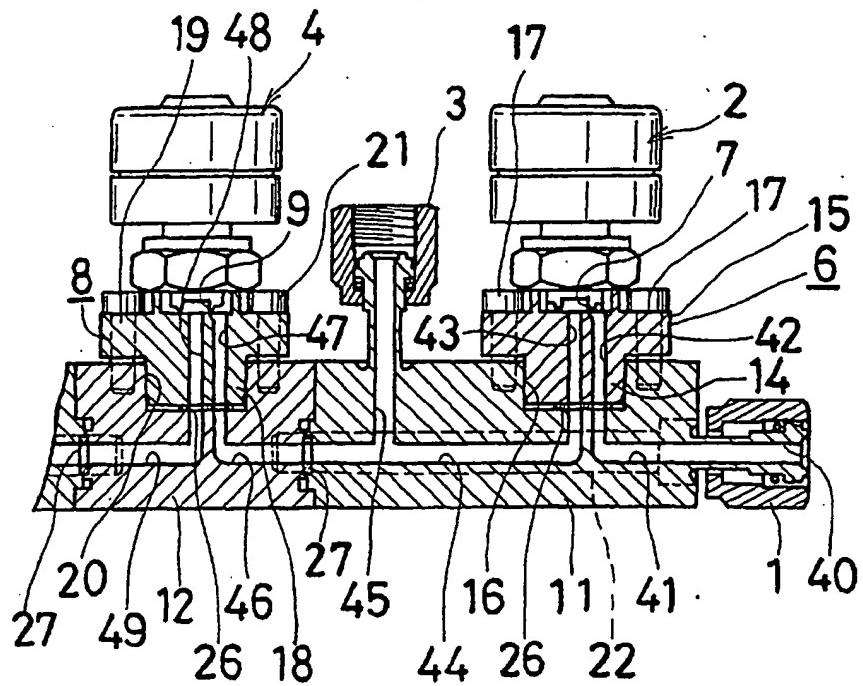
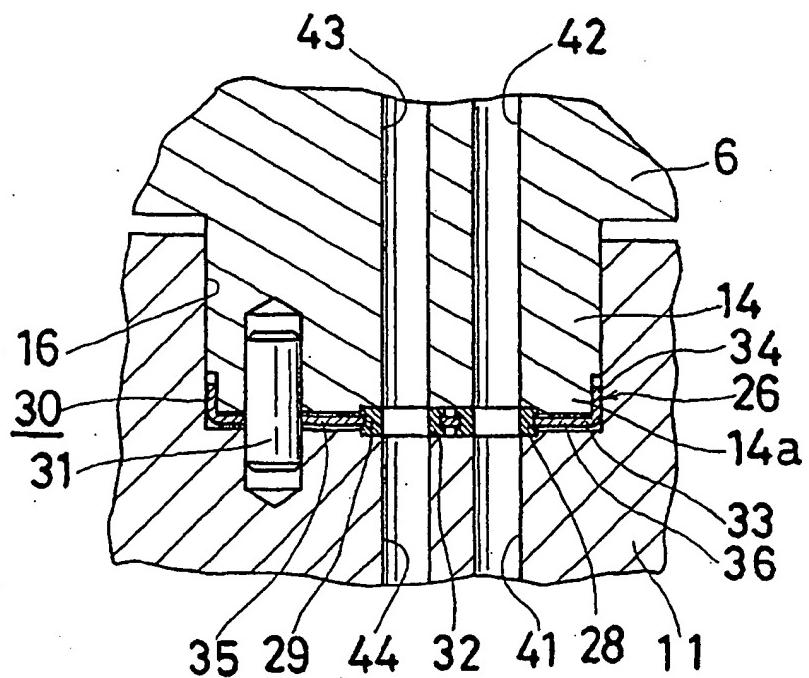


FIG.2



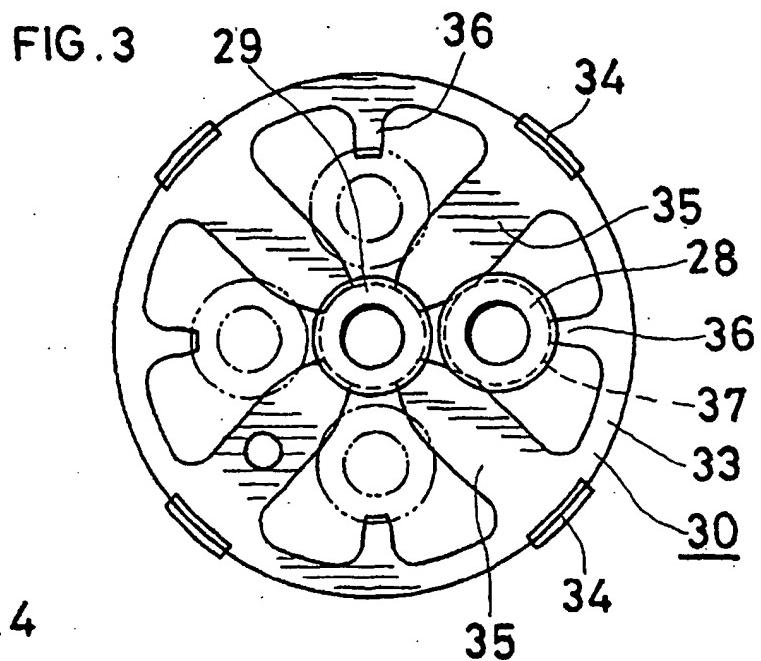


FIG.4

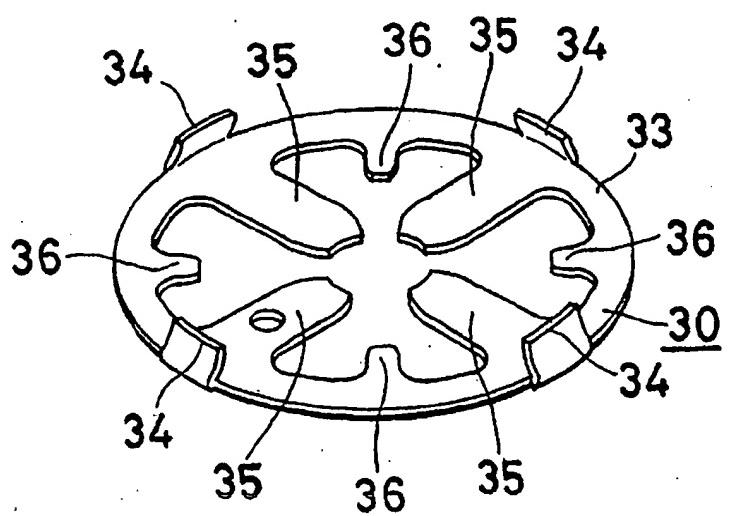


FIG.5

